We Claim

1. A device for aiding the analysis of signals containing a symbols-based digital modulation, this device comprising:

- a signal memory (100), for storing a complex digital signal (z(t)), representative in amplitude and phase of a captured signal, over a chosen duration, and
- processing means (200-900), devised to search within the complex signal for the properties relating to its carrier frequency and to the modulation of the carrier frequency as a function of a chosen modulation model,

characterized in that the processing means comprise:

- means (200) for determining an estimate of the tempo (1/T) of the modulation,
- projection means (510), devised to calculate the components (zp(t)) of the complex signal in a function basis (501; φi(t)), which is parametrized according to the said tempo (1/T) of the modulation, and
- calculation means (520), operating on these components, so as to determine at least one estimate relating to at least one property of the complex signal, within the group of properties comprising the elementary pulse shape (g(t)) of the complex signal,

the string of symbols (a(k)) of the complex signal and the carrier (f0) of the said complex signal.

2. A device according to Claim 1, characterized in that the said function basis (501) is parametrized so as to exhibit at least two samples per period (T) of the modulation ($q \geq 2$).

3. A device according to Claim 2, characterized in that the said function basis (501) comprises at least two functions ($\varphi 1(t)$, $\varphi b(t)$) which are deduced from one another by a temporal translation of chosen period ($T/2$; T/q, $q \geq 2$).

4. A device according to Claim 1, characterized in that the said function basis (501) comprises rectangular functions which are temporally adjacent to one another.

5. A device according to Claim 1, characterized in that the said function basis (501) comprises functions of the "raised cosine" type.

6. A device according to Claim 1, characterized in that the projection means (520) comprise:

- means (521) defining a digital filter, having an impulse response substantially equal to one of the said functions, this digital filter receiving the complex signal, and
- sampling means (523) for repeated digital sampling of the output of this filter at a chosen rate ($2/T$; q/T).

7. A device according to Claim 1, characterized in that the processing means are effective to determine (300) an approximate estimate fa of the carrier f0 of the said complex signal, as well as to demodulate (400) this complex signal through this estimate fa; and in that the projection means (510) are effective to operate on the complex signal (z(t)) after demodulation thereof through this approximate estimate, while the said function basis (501) is of low frequency, like the spectrum of the complex signal after demodulation.

8. A device according to Claim 1, characterized in that the calculation means (520) comprise means of matrix calculation on the said components.

9. A device according to Claim 1, characterized in that the calculation means (520) are effective to calculate an estimate of the modulated elementary pulse shape (gm(t)) in the form of a function of minimal support.

10. A device according to Claim 9, characterized in that the calculation means (520) for calculating an estimate of the modulated elementary pulse shape are effective to search for the pulse shape in the form of a function of minimal support, comprising a pulse shape of minimal support (hpm(t)), and a symbol train (cm(k)) associated with the said pulse shape of minimal support.

11. A device according to Claim 10, characterized in that the calculation means (520) are devised so as

to determine a representation of a subspace of minimal dimension of the function space, which subspace contains the said complex signal, and to search within this subspace for a direction orthogonal to each of the slices of the complex signal, the components of the eigenvector (V) associated with this direction being representative of the said pulse shape of minimal support.

12. A device according to Claim 10, characterized in that the calculation means (520) are effective to furthermore determine the symbol train (cm(k)) associated with the said pulse shape of minimal support.

13. A device according to Claim 11, characterized in that the calculation means comprise:

- means (610) for effecting an inverse filtering of the said pulse shape of minimal support, then for applying this inverse filtering to the components of the complex signal in the said function basis, and
- means (650) for effecting polynomial resolution on the result of this inverse filtering, including means (659) for selecting a set of solutions (am(k)) meeting chosen constraints.

14. A device according to Claim 13, characterized in that the chosen constraints (659) are the decorrelation of the symbols and the minimization of the variance of the modulus of the symbols.

15. A device according to Claim 10, characterized in that the calculation means are devised (700) so as to determine a correction ($\Delta f0$) of the initial estimation (fa) of the carrier, by searching for a frequency of demodulation of the residual which leads to a probability density with minimum entropy.

16. A device according to Claim 15, characterized in that the calculation means are devised (800) so as to produce a representation of the demodulated complex signal through corrected carrier estimation, with the pulse shape of minimal support.

17. A device according to Claim 16, characterized in that it comprises means (900, 950) for calculating an estimate of the entire set of possible states (ei) of the symbols in the complex signal.

18. A device according to Claim 17, characterized in that the means (900) for calculating an estimate of the entire set of possible states of the symbols in the complex signal operate by searching for local maxima of the probability density of the symbols.

19. A device according to Claim 18, characterized in that it comprises means (950) for calculating an estimate of the symbol train (a(k)) actually present in the complex signal, by searching, in respect of each symbol taken individually, for the possible state which is closest.

20. A device according to Claim 19, characterized in that it comprises means (990) for locally

reconstructing a signal having the carrier, the modulation and the symbols estimated, and for comparing this local signal with the initial signal, as stored.

21. A device according to claim 1, characterized in that the function basis (501) is associated with the entire set of linear digital modulations.